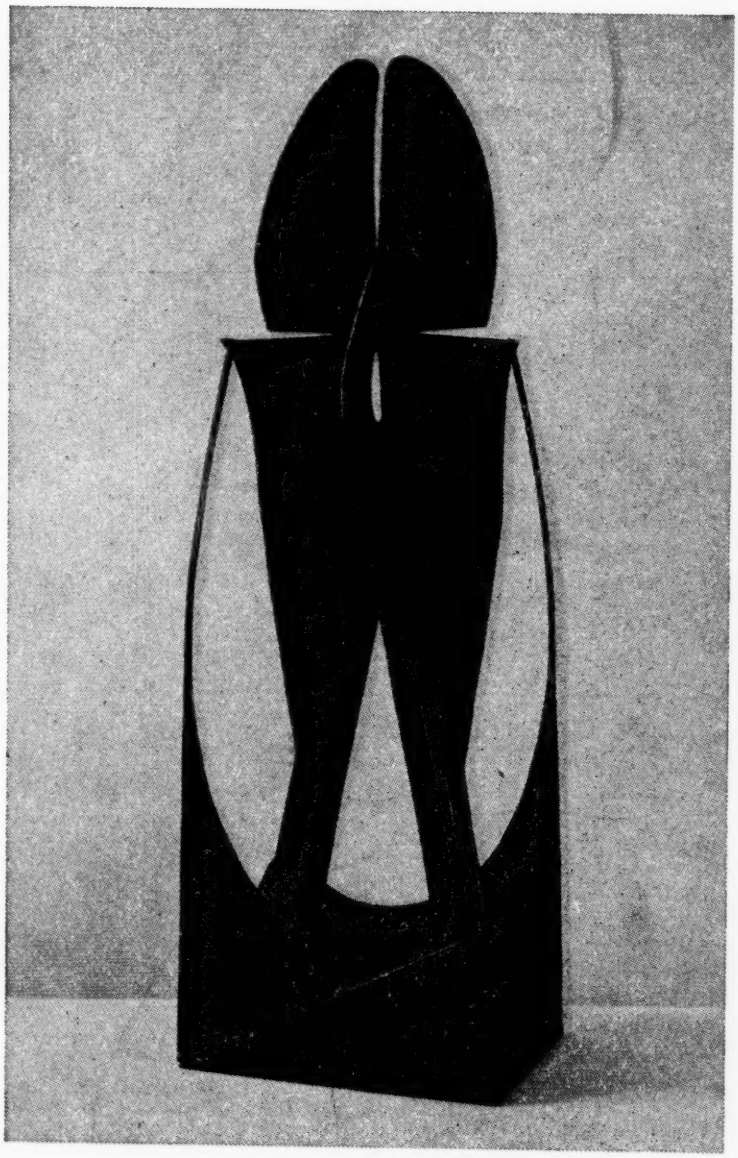
MAIN CURRENTS

IN MODERN THOUGHT



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MAIN CURRENTS IN MODERN THOUGHT

A co-operative journal to promote the free association of those working toward the integration of all knowledge through the study of the whole of things, Nature, Man, and Society, assuming the universe to be one, dependable, intelligible, harmonious.

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946. of MAIN CURRENTS In Modern Thought published five times a year, in Sept. Nov. Jan. March and May at Port Chester, New York for October, 1955 State of New York. F. L. Kuntz, who, having been duly sworn according to law, deposes and says that he is the Editor and Owner of the MAIN CURRENTS In Modern Thought and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily, weekly, semiweekly or triweekly newspaper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the act of August 24, 1912, as amended by the acts of March 3, 1933, and July 2, 1946 (section 537, Postal Laws and Regulations), printed on the reverse of this form, to wit: 1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher F. L. Kunz, Port Chester, New York, Editor F. L. Kunz, Port Chester, New York, Managing editor None, Business manager None. 2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and address of stockholders owning or holding one percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) F. L. Kunz, Port Chester, New York. 3. That the known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None. 4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him. 5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is (This information is required from daily, weekly, semiweekly, and triweekly newspapers only.) (Signed) F. L. Kunz (Signature of editor, publisher, business manager or owner). Sworn to and subscribed before me this 20th day of September, 1955. Mary E. Hoey, Notary Public, State of New York, No. 60181500, qualified in Westchester County. (My commission expires March 30, 1957).

MAIN CURRENTS IN MODERN THOUGHT is published 5 times a year in Sept., Nov., Jan., March, and May, to call attention to significant contributions to learning currently being made by workers in the multiple fields into which knowledge has come to be classified. It relates these advances to each other and to the classical and contemporary views of Eastern, European and American thinkers. It is designed to save time for the reader by providing a vantage-ground from which the whole world of knowledge may be surveyed and kept in proportion as it moves toward integration. Its editors assume that the principles of art, the universals of philosophy, the laws of Nature and Man as formulated by science, and the truths of comparative religion, can be orchestrated into a harmonic, meaningful, ethical body of teachings which can and should be made the central core of curricular study in the educative process at all levels of development. In condensing text, square brackets [ ] indicate editorial interpolation. Three dots . . . in the text indicates a word, phrase or passage omitted in the interest of brevity or clarity. Other usages are standard. $3.00 a year. Foreign $3.50. Contributors to MAIN CURRENTS enjoy full liberty of opinion and expression in these pages. Copyright 1955, by F. L. Kunz, Port Chester, New York. to whom all communications regarding MAIN CURRENTS IN MODERN THOUGHT should be addressed. Entered as second class matter April 13th, 1946, at the post office at Port Chester, New York, under the Act of March 3rd, 1879. (Reentered as second class matter November 17th, 1953, at the post office at Port Chester, New York, under the Act of March 3rd, 1879.)

THE ENIGMA OF MATTER

Adolph J. Stern

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Man's Continuing Search for an Understanding of Nature

EVER since man appeared on earth, he undoubtedly stood in awe and wonderment before the material world surrounding him. He observed the manifold actions and reactions of these material things as best he could and he attempted to find an explanation of "why" they happen and "how": the one question leading to philosophy or religion; the other, eventually, to the study of the nature of things —natural sciences—the problems and tasks of which are correlated closely to those of philosophy. Thus, next to the question, "What is life and what is its purpose?" the question, "What is this matter?" through which life manifests itself was always foremost in the mind of man.

The extent of knowledge of the actions and reactions of matter and the answer which each generation has given with respect to the nature of matter have deeply influenced culture and civilization. In the first half of our century, we have become too much accustomed to consider the study of the nature of things (natural sciences) purely from the utilitarian point of view. This is not surprising. The immense increase in knowledge of our surrounding world formed the basis for a technology which has changed our way of life and enhanced the comfort of our material existence beyond recognition during the last century. Nobody can even guess what the future outcome will be. This misunderstanding of science and its value and of the nature of matter has led to a materialistic interpretation of the findings of science, which in turn has contributed in no small measure to the materialistic outlook of our days. The main scope and aims of science, however, as displayed in its attempt to answer the question, "Who is man?" by trying to answer "how" things behave as they do, and then correlate this answer to the "why," are as idealistic and humanistic as the aims of philosophy or any other branch of human knowledge. It is, therefore, clear that the knowledge of the real nature of matter is of fundamental significance.

Ideas about matter have continuously changed in the course of centuries of human searching. Especially radical is the change in our century, which will be remembered for having brought about some definite progress in human thinking along these lines. Two fundamental concepts of matter have been developed to describe nature in the course of the history of scientific thought. The first of these has arisen from the fundamental desire of all who occupy themselves with science to achieve a continuous description of nature which is demanded by and interwoven with the idea of causality. For this reason, ancient philosophers considered matter as a continuum. This is an apparently simple concept of matter to which one is automatically led if one considers matter as reality, unchangeable and undestroyable, as it appears to the rather primitive sense perception of the ordinary eye which takes stone for stone, blue sky for blue, without deeper questioning. To such a view, it appears that when matter changes its state from the solid to the gaseous it simply expands, in a fashion called by the ancient philosophers rarefaction, a continuous spreading out, getting thinner and thinner in a gapless way. And, when condensing from the gaseous state to the solid state, the reverse would happen. However, it can be seen that such an apparently simple view of matter, as a continuum, leads to unsurmountable difficulties, even from the theoretical point of view. In the same way, it seems equally difficult to arrive at a truly continuous description of processes of physical nature, however appealing to us such a description would be.

Whatever the specific reasons for this failure of the postulate of continuum, it seems primarily caused by our still immense lack of knowledge of our surrounding world. It may be also caused by the fact that our thinking is derived from subjective observations of nature and that for us as individual beings, used to think in terms of definite entities and their summation to the whole, it is difficult, if not impos-

sible, to think in terms of infinite continuation—at least as far as matter is concerned.

It is understandable, therefore, that the second postulate used to describe nature, the atomistic view of matter, has proved to be much more successful, in fact, enormously so.

This theory, which was also developed by the ancient philosophers, is very old indeed. Democritus (460 B.C.) held that matter consisted of extremely small, solid particles called atoms, with large distances between them, and that these atoms, of the same size and individuality, were embedded in empty space. It is easy with this assumption to explain or describe the phenomena of matter. Transformation of matter from the solid to the gaseous (over the liquid state) is simply accomplished by these atoms gaining energy and moving further apart until their distances are so great that they are almost singly moving in empty space as "invisible" gas. By moving closer and closer together again, losing thermal energy, they appear as liquid, or still more condensed as a solid body. This atomistic view of matter has been and is still used (with important changes, however) as the best possible way of describing the properties of matter in agreement with experimental facts.

MATTER, which is everything on earth which occupies space and has weight, has a tremendous variety of appearances, and many attempts have been made to classify these different forms and correlate them to each other. It is impossible to describe here the historical development. The real progress has been made rather late in history, with the introduction of the scientific method. Leaving the domain of philosophical speculation, actual experimental investigations have been undertaken, not only qualitatively, but also, what is most important, quantitatively. It is well known that the great merit of the work of the alchemists lies in the discovery of fundamental units, elements, of which matter consists, even if they recognized only a few, somewhat unclearly. The definition of an element, until changed later, has been that it is a pure substance of matter which cannot be broken down into two or more simple substances with different nature. Extending chemical investigations, more and more of these elements or basic units of matter have been discovered and at the present time we know about 100 elements (not including isotopes) of which the whole universe seems to be composed.

Elements combine together to form molecules of compounds. A truly great variety of possible combinations of these elements makes up the different types and classes of matter which we observe in nature. Dalton (1803) was the first to show by quantitative measurements that certain elements combine in a definite ratio by weight to form a compound, and to prove experimentally in this way, the existence of certain units, atoms, which combine in a very lawful and definite, unchangeable ratio, according to their established combining capacity. This was a spectacular success of the atomistic theory of matter, which until then had been rather philosophically postulated.

The important law of definite combining weights of elements postulates the existence of atoms which must be attracted to each other and fastened to each other by bonds of some kind, and that each element is provided with a definite, specific number of bonds with which it can attach itself to another. The number of the bonds of each different element represents then its combining capacity (valence). The law of the conservation of mass states furthermore that during such a combination of elements—or any other chemical change—matter remains constant with regard to its weight as well as nature. During almost the whole duration of the 19th century atoms were still considered solid, extremely small particles with a definite combining capacity, whatever this might be. Matter seemed to be a permanent thing which always was in existence and never could be destroyed. Moreover, matter in its atomic and molecular motions was behaving logically, according to strict established laws, and according to well defined forces existing between the different particles of matter. It was possible to predict with "certainty" the behavior of a particle under different conditions and the outcome of a reaction, once the initial conditions were known. The physical as well as the chemical behavior of matter seemed to be well described by relatively simple mathematical relationships.

DISCREPANCIES appeared here and there however, and some lonely thinkers still pondered the nature of matter, its reality, its creation and destiny. With the discovery of radio-activity and radioactive elements, primarily radium, by Becquerel and Curie, a revolutionary change occurred with respect to the nature of matter. First of all, here was an element, radium, which emanated radiation and by doing so was converted into another element, known already as lead. In its behavior, radium definitely disobeyed the "established" law of conservation of mass. For the first time in the history of science, a biological term, "life time," was introduced into a science which seemed utterly inorganic. Matter seemed now to have the character of "living things,"which have been created and after a certain time—even if that time-span might be of astronomical dimensions—will be destroyed, or transformed again into other elements or into radiation. In addition, the discovery of the radio-active elements permitted for the first time a real insight into the structure of atoms, and therefore of matter. It was soon found that the radiation given off by those radio-active elements consists of positive helium atoms, negative electrons and gamma (or x-ray) radiation. It was thus clear that atoms must be composed of positive and negative charges, the positive charges being connected with

"heaviness," with mass. This deeper insight made it also possible to postulate the structure of the atoms of different elements, which until then were thought of as completely solid. Lord Rutherford, Nils Bohr and Sommerfeld (1911-1920) primarily attempted to describe atoms as consisting of postively charged nuclei (which carry mass) and negative electrons with extremely small weight which somehow rotate around the nuclei in planetary fashion.

The relative weight of the atoms of the known elements had been established some time before. Hydrogen, being the lightest of all the elements, was given the weight of one, and it was evident that the amount of mass of the atoms heavier than hydrogen must rest with the number of positive charges. Hydrogen, therefore, must have one positive charge (weight one) and since the atom of hydrogen is neutral, it must be surrounded by one negatively charged electron, somewhere in an outer orbit. With increasing heaviness of the different atoms more positive charges must be in the respective nuclei and an equivalent number of electrons surrounding them. How many positive charges each element will carry was determined by Moseley (1913).

IN the middle of the last century, Mendeleev (1869) gave the long suspected relationship between atomic weights and the properties of atoms of different elements a definite expression, by systematically arranging the atoms according to increasing atomic weights. In so doing, it could be shown that elements with similar chemical properties fall together in small groups, eight groups being distinguished as necessary to classify all elements known at this time according to combining capacities and other chemical properties. Moseley showed that a better arrangement was possible, according to so-called atomic numbers, that is, the number of positive charges in the nuclei of atoms, which he was able to determine by means of the order of the x-ray frequencies produced when the specific elements are used as targets. Discrepancies appeared, however, when for instance an element with atomic weight of four (helium) was found to possess only two positive charges instead of four, as expected. It soon was established that the nucleus of an atom may contain, and in almost all cases does contain, particles (discovered by Chadwick in 1932) with a mass of one but with no charge whatsoever, a neutron. It had to be assumed that the missing weight, of two in the instance of helium, is contributed by the presence of two neutrons with the mass of one each, but with no charges.

It was thus postulated that matter in its different forms is composed of positive charges which carry weight, and neutrons which carry weight but no charges, both within the nuclei, and of electrons somehow arranged in planetary fashion around the positive nuclei in enormous distances from them, rotating with high speed to overcome the attraction of the opposite charges. Chemical reactions, combining capacities, and so forth, are in this way determined by the number of electrons in the outmost sphere and by their magnetic behavior. The modern arrangement of the atoms according to their atomic numbers and their properties in "periodic" tables shows the harmonious, periodic law which underlies the apparent random action and reaction of matter as manifested in the macroscopic world. It also shows the harmony in the distribution of the electrons, of which the respective atoms are composed, in different, discrete energy levels.

The postulation of these atom models was an important step on the way to better understanding of the nature of the atom and the nature of matter. Soon, however, it was evident that these models were quite insufficient and inadequate to describe many of the important experimental facts of the physical behavior of the atoms, such as emission spectra, photoelectric effect, chemical bonding, etc. The mathematical description of even the most simple atom, that of hydrogen, using concepts of the classical mechanics, created unsurmountable difficulties. It was impossible, for instance, to describe correctly the movement of an electron in its supposed orbit, rotating with such high speed and assumed to be such a very small particle, by using the common mechanical laws of macroscopic bodies. It was necessary to abandon a precise mechanical description of nature and to accept a mathematical description. This meant leaving, to a high degree, the realm of our ordinary world of sense perception and establishing a mathematical relationship beyond our world of "reality."

THE beginning of the breakdown of a purely mechanical description was initiated with the investigations of Planck (1900) who established the quantum theory. He found that radiation given off by heated bodies at various temperatures is not emitted in a continuous stream, but in discrete, discontinuous units which are called quanta. Actually, these quanta are to be considered somewhat as "atoms" of energy. These findings of Planck were of the greatest consequence, and influenced Einstein (1905) to carry the idea further and conclude that all forms of radiant energy, such as light, heat, and so on, consist of definite quanta. Radiation, according to this accepted view, is composed of individual particles which fly with high speed, the velocity of the particles depending on the character of the radiation. Light, therefore, is considered to consist of quanta called photons. This quantum theory gave an excellent description, for instance, of the photoelectric effect. The interaction of light with an electron could easily be described as similar to one billiard ball (electron), being hit by another (photon). The reaction then depends on the impact of the photon upon the electron. Using the quantum theory, the discrete electron jump from one energy level to another within an atom could be better understood, as Nils Bohr had already pointed out.

The postulate of the quantum theory as applied to light by Einstein was in complete contradiction to the prevailing view of the nature of light. Huygens (1690) considered light as made up of waves, the wavelength of which depended on the type of light. From that time on, the wave theory of light was considered as one of the fundamental theories of physics. It was completely developed by Maxwell (1864), who considered light as electromagnetic waves and introduced fundamental field equations by means of which not only all features of the wave-like behavior of light could be described, but also the dynamics of electricity as well. These field equations form the basis of our knowledge of electricity and light and have been enormously successful in general application to wave problems. There is no doubt that there are phenomena of light, such as diffraction and interference, or the "bending" of light around a very fine wire without the wire casting any shadow, which cannot be explained otherwise than by the wave theory.

The dualism between light, or radiation in general, and matter had for a long time disturbed physicists in their attempt to bring natural phenomena into one unified picture. De Broglie (1925) suggested that phenomena which deal with the action of matter and light could best be understood by assuming that electrons are not particles but systems of waves. Nevertheless, it is true that all electrons seem to have the same mass and the same negative electrical charge and it is, therefore, reasonable to conclude that they should be particles of fundamental nature. Davisson and Germer showed experimentally that electrons indeed do exhibit wave characteristics. Electron beams show diffraction in the same manner as ordinary light, and they actually can be used in place of light waves in instances where extremely short wave lengths are required, as in the electronmicroscope. The electrons represent, according to this theory, "matter waves."

ANOTHER important event took place at the beginning of this century, with the introduction of the principle of relativity by Einstein (1904). One of the fundamental statements of this theory is that mass is not at all constant, but subject to change according to the velocity with which it moves. This property of matter becomes evident to a noticeable degree only with particles at high speed. Moving electrons in electrical fields can be speeded up to a velocity close to that of light with a definite increase in mass. With increase in velocity, mass increases. Einstein concluded further that since particles increase in mass by increased motion, and since motion is energy, the increase in mass must be caused by the increased energy of the particle. This means nothing less than that energy has mass. From these facts, Einstein derived his now famous and most important equation correlating the equivalency of mass and energy. This discovery is one of the most outstanding of our century and its implications and applications to everyday living (nuclear bombs, nuclear energy) become more evident from day to day.

THIS revolutionary change in our view of matter, the "matter waves" of de Broglie, has been further brought into a mathematical form by Schrödinger, Heisenberg and Born (1927). Protons (positive nuclear charges with mass one) and electrons are mathematically expressed as specific wave functions, using sometimes highly specialized wave equations. With this "wave mechanics" an attempt was made to bring into agreement the two facts that on one hand matter behaves as if it were composed of individual particles, and on the other hand it exhibits characteristics which would indicate wave-like nature. Atoms or even molecules are indeed diffracted by crystal surfaces, showing "wavelengths" in agreement with the mathematical description of wave mechanics.

Wave mechanics are able to represent very accurately with field equations the interplay of matter and radiation and the interdependence of wave and mass. It makes it possible to define mathematically the fundamental phenomena beyond the range of our sense perception more exactly than will ever be possible with mechanistic models. The consequence of this interpretation is that we have to abandon the idea of ever being able to "really" know what the forces of nature, like electricity, magnetism, gravity, matter, are. Rather, matter becomes a mathematical term, an imagination of our mind. Any model which we would like to draw of any of the possible known particles, from molecules as large as those of proteins on down to protons, electrons, positrons, mesons, etc., will necessarily be at best an approximation, representing an interpretation of partially known facts with absolutely no claim of "reality" or truth and only helpful as a guide. This is the price we evidently have to pay for securing, again with the help of wave mechanics, a continuous description of nature and its forces out of the discontinuity of atoms and quanta, which are, according to their very nature, irreconcilable with a continuous description in space and time.

But it is also true that a wave mechanical interpretation of matter is, so far, in best agreement with experimental facts. The behavior of these different particles and their interdependence can be described very accurately and it is not at all necessary to know what they "really" are.

Another great step forward, it seems, has been achieved. The unification of an enormous number of experimental facts and of various forces formerly considered entirely different under one great denominator has been accomplished to a far greater degree than was ever possible on a classical mechanistic basis. The abandonment of "reality" and of pictorial representation of different parts of the whole, in order to achieve this unification, is indeed worthwhile. Knowledge in a small sphere is of little use. Integrated knowledge, even if only of the broader aspects of total human achievement (in physics, chemistry, biology, geology,

music, art, etc.), can offer to the human spirit rewards far greater than a thorough knowledge of parts of specialized disciplines can give.

NO matter how future scientific research develops, one experience stands out clearly, namely, the harmonious, lawful behavior of all forces which make up our world, regardless of the system under which we prefer to observe and classify the known facts. It can only be logically concluded that great uniformity must also prevail in nature. It seems that all fundamental units which make up matter, and the forces which govern it in its action and reaction—electrons, protons, waves of matter, molecules, etc.—are in this universe of waves only different manifestations of the same basic, universal, immaterial force. A field is space filled with some kind of energy which exerts its force upon an object brought into it. Only in this manner can its presence be detected. Waves are expressions of fields and, so to speak, are considered to carry their own, underlying fields with them. Matter-waves, or matter, are condensed field energies caused by disturbances, and this matter in its immense variations is the material of which our world, including all living beings, is formed.

All these modern ideas regarding matter have a profound influence upon the philosophy of science and upon human thinking. There is no need to be discouraged over the apparent inability to recognize "reality" and "truth" with our limited senses. The recognition of truth can be achieved by entirely different methods, by inspiration or revelation, and belongs in the domain of religion. On the other hand, the success reached in penetrating the unseen by scientific means is stimulating and we are still at the beginning of deeper insight. The hope that man will succeed in his yearning for discernment is cherished by physicists and philosophers alike.

Thanks to the wave mechanics, casuality and determinism are maintained, in spite of the statistical approach which must be pursued when dealing with the behavior of countless individual particles, atoms and quanta. It is at least tempting to suggest that these unseen forces of fields, which are hidden behind all the matter or particle-waves which make up our visible world, include also the forces which we call mind and spirit. They might easily be the universal power, filling all space, from which all life originated and to which it shall return.

Nothing is of more importance for the public weal than to form and train youth in wisdom and virtue. Wise and good men are, in my opinion, the strength of a state far more so than riches to arm.

All who have meditated on the art of governing mankind have been convinced that the fate of empires depends on the education of youth.

Knowledge: Most potent of weapons.

An investment in knowledge pays the best dividends.

Taxes are indeed very heavy, and if those laid on by the Government were the only ones we had to pay, we might more easily discharge them; but we have many others, and much more grievous to some of us. We are taxed twice as much by our idleness, three times as much by our Pride, and four times as much by our Folly.

Education is the biggest business in America.

Nature keeps a school that should be better attended.

—*Benjamin Franklin*

TOWARD THE KNOWLEDGE OF MAN

Ordway Tead

Columbia University

An Unorthodox Approach To College Studies

PART II

REFERENCE, suggestive rather than systematic, will now be made to an extension of the study of selected conceptual problems, as further illuminating some of the usually opposed intellectual claims and principles which the confrontations of life thrust to the fore and in so doing create a demand for a resolving of the conflicts. These polarities of thought are of such a permeative character that they are not ignored in the reflective adolescent period when life attitudes are taking shape. It is not that on such issues easy or final answers are forthcoming but rather that both teachers and students have to bring to their considerations the fullest insights of contemporary thought. This should be undertaken in discussions which essentially cut across subject-matter lines.

I am referring to the following areas of tension, polarity or dialectic which plague us with the confusions they create in thought and practical affairs both personal and social:[7]

Absolutism versus relativism
Objectivity versus commitment
Authority versus freedom
Egoism versus altruism
The state (and all other large corporate organizations) versus the individual
The secular versus the sacred

A brief characterizing of the more obvious aspects of these polarities may have suggestive value.

Absolutism versus Relativism

THE issue here is at once philosophical and practical. As Professor Robert Ulich of Harvard so well says, "We continue on one hand to hold older idealistic concepts of education, especially when we speak of aims, values, and the 'American way of life'; on the other hand we pursue the scientific and relativist approach, with no meeting between the two. Our students are constantly torn between these two interpretations of life."[8]

On the practical level of moral commitment and conduct, the inroads, for example, of comparative cultural anthropology have been profound among college students, especially when one adds to this point of view as advanced in some anthropological instruction the impact of an oversimplified "scientism" which assumes that all truth is tentative postulate and all knowledge relative to each discrete situation. Right and wrong, the good and the beautiful—these are all relative to specific conditions and cultures. This is a widely accepted view. If it means that every individual and every culture are to set their own standards and that there is no more ultimate set of values to be derived, surely there is left nothing but moral anarchy. And that is, indeed, what often appears to be the fact in the attitude of too many teachers and students.

There is, indeed, a too prevalent blind spot with respect to the opposed view which holds that historically there has been an astonishing consensus as to what is morally defensible and necessary. There is too little acknowledgment that the science of nature and the science of man together and progressively shed a confirming light on the view that there is an absolute mandate upon us to probe always more deeply for the meaning of this natural law which can illuminate our understanding of rightness and wholesomeness respecting man's status in the world.

We are coming to realize that it is in the nature of things that men *have* to pursue, discover and seek to realize the excellent as valuable, and that the excellent is approached both by rational grasp and spiritual insight. We strive by relatively effective endeavor to approach that excellence which is basically absolute in conception. Here is relativism of method and result, but absolutism of compulsion and aspiration—the mandate upon each individual always to be informed by education, so that specific judgments, decisions and choices become better guided toward the requirements of an orderly, law-controlled cosmos. An ancient utterance seems to have its modern support when it says that the ignorance and waywardness of the fathers are

[7] I am indebted to Professor Huston Smith in his *"The Purposes of Higher Education"* (Harper & Brothers, 1955) for these six ideas. His own discussion of these is more extended and more philosophical than mine, and deserves wide reading. I have elaborated more fully on this thesis and the reader is referred to my address, "The Roots of Teaching Power in the American Culture." See the *Seventh Yearbook*, 1954, The American Association of Colleges for Teacher Education.

[8] "Requirements in Education," MAIN CURRENTS, Vol. 10, No. 1. September, 1953.

visited in adverse consequences upon the sons unto the third and fourth generations. And of another familiar dictum the modern rendition is that the effort toward understanding the essential order of God's world is the beginning of wisdom. That effort toward understanding has in considerable part to be pursued deliberately in the channels of education.

Objectivity and Commitment

THE second opposition of attitudes may also be somewhat reconcilable. In the rigorous pursuit of understanding the natural law (or the effort to describe how to order our life in nature and society), there has to be objectivity of inquiry. Yet the passion for scientific truth-seeking is itself an evidence of concern and commitment. All effort to advance understanding has to be disinterested as to the facts; but the use to which the new understanding is put is a matter of commitment.

We tend to be confused as between objectivity which is necessary in specific circumstances and a neutrality which in effect says, "You pay your money and you take your choice," or the (all too prevalent) attitude of the teacher which says, ". . . on the one hand and then again, on the other hand . . . I leave it to you, my dear young people, to make your choice."

The *Bulletin of the Atomic Scientists* supplies heartening evidence of a new, morally-responsible and committed outlook among the natural scientists themselves — evidence which is reenforced by the more philosophic recent pronouncements of numerous other scientists both here and abroad.

I repeat, the point is that none of the scholarly disciplines—natural sciences, social sciences, and humanities—can remain exempt from concern about the consequences of their insights and of their possible applied uses. And the consequences are inexorably *moral* in character; that is, they have to do with the way in which people act in the light of new awareness together with an appraisal of the human results achieved.

Authority versus Freedom

WE have the dogmas of the past, exercising their authority upon our minds almost unconsciously, yet we have the educational duty to see through and beyond these dogmas toward a more inclusive integration for purposes of current relevance.

Are we to be overborne by authoritarian determinisms? Or are we to look at man as purposive, creative, and productive—capable within recognizable limits of freely striving to realize his always freshly emerging potential? Life and the world may be justifiably viewed as facts with their antecedents, but also as value, and as possibility; and no one of the three views *alone* accounts for the realities of the human scene.

Our genuine freedoms are surely away from the dogmatisms and authoritarian claims of state or church or science or whatever, in the interest of a society open-ended toward the future with reason and spiritual insight gradually gaining greater influence. If we accept the democratic view of the integrity, uniqueness and preciousness of each individual, the view that men are first ends in themselves and not means to the ends of others, then the freedom of the person, rationally and spiritually, has to be affirmed. And it has to be protected.

Egoism and Altruism

HERE we have familiar opposites which have been too sharply contrasted. Egoism can be conceived as concentration on the self narrowly viewed. But it can with greater penetration be regarded as a maximizing of all the qualitatively best characteristics which go to creating an outreaching and unlimited selfhood.

We are not ignorant of the ways by which selfhood is deepened and given its most productive effectiveness. "He who would save his life, let him lose it," shows a profound insight into the sources of human aspiration and salvation. Historically, the greatest individuals have been those who subordinated themselves most completely to the claims and compulsions of a cause beyond their little selves. And the evidence of history concerning those who exercised power largely through violence in displaying their egoism and egotism, has been that they eventually destroyed themselves.

Altruism, on the other hand, has tended, especially in its Christian interpretation, to be a "give-away." If everyone gives, who receives? If the other person is the only focus, what does one have to receive no less than to give? What of companionship, mutual self-respect, equality of creative opportunity and exchange? "Thou shalt not profit in self-righteousness," it has been profoundly said, "by thy neighbor's need." The real profit is in maximizing and enhancing personalities in mutual and reciprocal efforts that all concerned shall become significant and creative as selves.

Each person, as he is most productive in his unique way and is being creative in a spirit of rational love, is at the same time fulfilling selfhood and achieving the rightful expression of his altruistic desire and sentiment. Reciprocal creativity in humility and loyalty to a great community is surely the approach toward a reconciling of these falsely posed opposites. In short, each person at his best with his best is carrying his share of society's mandate for him.

The State and the Individual

WORLD events of the last three decades have brought this ancient dichotomy into sharper relief than ever. We have, indeed, become so reiterative together in the Western countries about this issue that we may well have all but lost sight of the nuances of the problem.

I find myself with occasional misgivings about the completely "either-or" character of so much American discussion of the state versus the individual as it is brought to bear upon the East-West situation. Democracy is presumably to be regarded and taught as

absolutely valid, as unquestionably perfect—at least in conception. And any other political or economic doctrine is all wrong. Yet as educators we do a disservice to ourselves, our fellow-citizens and our students if we fall in with this oversimplification of the reading of history and of current economic relations. The growth of democratic faith, hope and practice has in large measure happened to parallel the growth of western nationalism, imperialism, and colonialism. And the indirect result of this synchronous development has been that we in the West have almost unwittingly at times supported those governments, parties or groups in our foreign relations in less developed countries which seem oblivious of the triple afflictions of hunger, landlordism and corruption that dominate social realities in those lands.

American democracy means and stands for something deeply intrinsic. But this knowledge and meaning are not quickly conveyed to peoples with wholly different traditions who are suffering under prolonged political and economic repressions.

Whatever we may say philosophically about the integral place of the individual within our own democratic state, we are not likely to bring understanding to our students about the ways of strengthening a United Nations toward One World if we confine our instruction solely to clichés about our national rightness and the errors of those peoples who do not yet accept our outlook and methods at every point and in all places.

A second broad observation is that modern insights read into these concepts of the individual and the state different connotations from those of even a couple of generations ago. The differences make the ideas much more complementary, and surely more profound and intellectually adequate. The idea of individuality now acceptable is a dynamic one in which attention is focused on the critical role of the nurturing process, the directions which growth can be helped to take, and the institutional ways of releasing the needs, desires and qualities discovered to be potential in the individual.

We realize how malleable the self is and how susceptible to satisfying appeals made under favorable conditions in which the all but complete interdependence of person and society is the recognized reality. Rugged individualism gives way to social individualism.

It is this reality which forwarded our attention in various fields of personal and group efforts to the importance of what is now identified as "human relations." Definition of this as a field of study is still exploratory, but that it is destined to become much more precisely defined and generally studied is a reasonable prediction.

The idea of the state has likewise enjoyed a sea-change. The idea of the best state as that which governs least is losing its appeal and validity. An opposite idea of the state as a transitional authoritarian force of public power designed to assure that the capitalist state "withers away" is even more repugnant to us. Somewhere between these extremes the idea of a mixed economy controlled by social democratic purposes, and serving a democratically-administered public welfare, gains increasing understanding, acceptance and operation. There are, in fact, two kinds of "welfare-state"—the one paternalistic and more or less authoritarian, the other democratic and fraternal in aim and method.

Within the frame of this approach comes also the confronting of the modern corporation with the need of assuring that it can become an instrument of productivity, welfare and individual personality growth. If, as it has been wisely said, "you cannot seek the good life apart from the good state" (Huston Smith), it becomes equally true that the good corporation has to become a fact for the assuring of the good life and the fulfilling of the potential selfhood of each employed individual.

Thus individual and state as discrete ideas join forces, so to speak, in their modern connotations to illuminate our understanding of each. Indeed, these modern versions of old ideas do something more. They place and validate—in personal, political and spiritual ways—the idea of democracy itself. For one intention of real democracy is to assure that a major creative channel of individual self-determination and self-expression has to be in and through our necessary participation in the state, in corporate activity and in many other large institutional agencies. Democracy in this view is to be seen as at once the end, the process and the means or methods through allegiance to which the potential freedom of individuals in organizations is achieved. It is not accidental but intrinsic that the deep justification of democracy is that it is a form of social control at once protective of personal freedom and conducive to responsible, individual creativity.

The Secular versus the Sacred

A final example of polarities is perhaps the most recent in its impact upon thought and conduct. The secular I am construing as the attitude which accepts the human for its own sake as the only needful assumption or awareness. It takes the view that men's own affairs of, for, and by themselves are all that matter.

The inadequacies of this view may be realized when we look at the impact of our technology (inevitable and desirable though it is) upon countries and peoples where other values more "spiritual" in character, more preoccupied with man's relation to God or gods, howsoever interpreted, have been the dominant cultural influence. Indeed, part of the tension of today's world encounter of civilization with civilization has to do with this secular preoccupation of the West confronting a different set of presuppositions on other continents. One of the roles of education at the college level is to identify and clarify the elements of this inevitable problem of world conflict among plural value systems.

A present criticism within our own land is that education has become too secular in emphasis, subject-

matter and philosophic orientation. The question is widely posed: what are the place and influence of moral and spiritual values throughout our formal education effort? Can we get education to transmit a more affirmative moral or ethical influence? Are the public schools and colleges "godless" in some detrimental way?

All this bears in one aspect on issues of the separation of church and state, of state support for church-related schools, of the possibility of any kind of instruction about religion in public education. I shall not here address myself to these issues as they have overtones of legal interpretation. It rather seems to me essential to approach the relation of religion to education more profoundly in relation to human need as broadly viewed.

To this end I ask what is the nature of the sacred? Is there in our thought too sharp and rigid a dualism?

Let us start with a quotation from a distinguished and scientifically impeccable psychologist which may lead us on toward a more profound point of view. Professor Gardner Murphy in a recent address "The Nature of Man" has said, "One direction in which we find increasing confidence is the conception that we are basically one with the cosmos instead of strangers in it."

Another quotation is by one whose identity I will reveal at its conclusion:

> "There are no doubt sufficiently profound distinctions between the ethical process and the cosmic process as it existed prior to man and to the formation of human society. So far as I know, however, all these differences are summed up in the fact that the process and the forces bound up with the cosmic have come to consciousness in man. That which was instinct in the animal is conscious impulse in man. That which was 'tendency to vary' in the animal is conscious foresight in man. That which was unconscious adaptation and survival in the animal, taking place by the 'cut and try' method until it worked itself out, is with man conscious deliberation and experimentation. That this transfer from unconsciousness to consciousness has immense importance, need hardly be argued. It is enough to say that it means the whole distinction of the moral from the unmoral . . . I question whether the spiritual life does not get its surest and most ample guarantees when it is learned that the laws and conditions of righteousness are implicated in the working process of the universe; when it is found that man in his conscious struggles, in his doubts, temptations, and defeats, in his aspirations and successes, is moved on and buoyed up by the forces which have developed nature; and that in this moral struggle he acts not as a mere individual but as an organ in maintaining and carrying forward the universal process."[9]

[9]From *The Monist*, Vol. VIII, pp. 340-41 (April 1898). Quoted by Robert Ulich in *The Human Career*, Harper & Brothers, New York, 1954.

The author of this perceptive statement is none other than John Dewey, who is not usually thought of as espousing this kind of expression.

If humanity is in some profound sense at one with the cosmos, if there is a great Order which encourages the self-reflective element in life, if man is buoyed up by the same forces that developed the world of nature —then one is surely warranted in talking seriously of the sacred in life and of the sanctity of all life under auspices transcending man himself.

Did man create himself? Did he put himself here? Did he order that which the 200-inch telescope at Palomar reveals to him of an expanding universe? Did man contrive or only come recently to awareness about the indeterminate dance of the atoms? Did he supply the creative purposiveness and reconstructive powers in living cell tissue? Did man invent or is he required to fulfill his own innate "social appetite," his need for belongingness and for love?

I am trying only to suggest that the new look in the human scene belies and destroys the verbal curtain separating the secular from the sacred, or the divine or the suprahuman, or that Power or Ground in life which transcends our understanding.

We may choose to ignore or be sceptical about the sacred; and that is secularism. But the world does in fact seem saturated and permeated with its own mysterious but organic divinity beyond full human comprehension. Is it not wiser to say that the sacred—in this sense of the mystery or sanctity of the process animating and pervading life — infuses our living whether we will or not? Where we do consciously will our own cooperation with these processes up to the measure of our knowledge and understanding, the processes of human advance do in fact seem aided toward purposes we can dimly but increasingly grasp.

But are not logical positivism and scientific humanism enough? If one asks, "In what sense 'enough'?" I reply, "Are they enough to account for that in the cosmos which we persistently feel bound to account for—all of it beyond the realm of scientific test, experiment or proof in the literal sense?" I refer, for example, to our vivid and unanalyzable exultation as we experience beauty, human love, heroism, sacrifice for principle, commitment to great causes, the sense of awe before the mysterious—all of which are unassailable human facts.

I reply further that once the sacred is recognized in its full purity as above and beyond the sectarian or doctrinal in the organized religions, the sacred gives height and depth and universality of meaning to the human career. It gives also a sense of personal moral obligation which I find it impossible to derive so imperiously from a secular humanistic view. All of us live by faith; the problem, educationally and religiously is by what *kind* of faith in *what?* The upthrust of human curiosity and aspiration seems to me to impel us irrevocably to pose this question to ourselves in terms more than rhetorical, and to seek answers beyond the realm of "human relations."

I have introduced these oppositions of familiar concepts as bearing on our greater knowledge of man if wisely studied at the college level. In some of these six instances helpful reconciliations of view seem reasonable and in others some integration of new truth may be possible. But ignoring them because they do not happen to fall into some subject syllabus is what we cannot continue to do. And beyond this is the truth to be apprehended that for many convictions we may believe we rationally hold, we would do well for fuller rationality to seek to probe the reasons why others hold the opposite view. Valery was right in referring to "the fecundity of opposites." The dialectic of thesis, antithesis, synthesis has wider applications than have been suggested for it. Some of the writings of F. S. C. Northrop, notably his "The Meeting of East and West" suggest ideas illustrative of the application of this method to some underlying differences of philosophic and religious outlooks as between the Orient and Western societies.

VII

MY final approach to the relation of a knowledge of man to his better education has to do with a consideration of the *religious mood* as one to identify, to be clearly conscious of, and indeed to cultivate in the teaching effort as a necessary means of deepening the insights of student learners.

My concern here has to do with the impartation of "moral and spiritual values" in some penetrating way that may give rightful stress to those human attributes, characteristics and responses which in their totality become "religious" in the purest and highest sense. Beyond the legalisms of discussion of the "separation of church and state", beyond the solicitude that higher education—at least where publicly conducted—shall have no suggestion of countenancing religious propaganda, is it not possible to view the moral and theological issues of honest men more universally, more under the aegis of eternity? If we can keep the idea of what *is* religious dissociated from the doctrine, dogma, denomination or sect, if we can identify the components of a religious mood, may not that say something to teachers as to the texture and overtones of their teaching? If, as I believe, the moral and the spiritual are caught and not taught, clarification of meaning and direction here may well be helpful to teachers in terms of depth of awareness.

I use the word religion in its most generalized sense. One of Whitehead's definitions is that "religion is the longing of the spirit that the facts of existence should find justification in the nature of existence."[10]

In like vein, another definition (unidentified as to source) is that "religion is man's ultimate concern for ultimate reality." And Tolstoi defined it as a "relation accordant with reason and knowledge which man establishes with the infinite about him and is such as binds his life to that infinity and guides his conduct."[11]

In the broad and deep frame of such a view of the nature of religious concern, I believe with others who have been pursuing this approach that with some historic accuracy and some psychological corroboration the following moods or modes or component elements can be set down as embodying essential aspects of a religious spirit.[12] Indeed, in their aggregate, deriving as they do from widely if not universally acknowledged qualities or desires manifested in human experience, they present a pattern of natural response which yet transcends the deliverance of the senses. Nor is the fact that not every mood or mode may be in the consciousness of everyone a reason for ignoring this approach; for it is obvious that among individual differences are those of religious sensitivity.

Composite of the aspects or attributes of what thus comes *close to high religion as man in his best self-knowledge comes to know and speak for himself* are these:

1. the individual is impelled to activity, performance and accomplishment in and through which creativity is made manifest as his "vocation";
2. the individual comes to accept the inevitable reality of continuous change, flux, novelty, and uncertainty;
3. the individual comes in another phase to know his continuing self-identity as giving some stability and permanency within change;
4. the individual has some awareness, varying in its intensity, of dependency on some powers and forces not himself, not fully identifiable or definable, but rather mysterious and ineffable;
5. the individual may on occasion be possessed of a feeling of inner peace and tranquility of spirit, perhaps deriving in part out of the sense of dependency;
6. the individual apprehends some underlying order and progressive lawfulness in the nature of things and in his relation to them;
7. the individual comes to grasp the reciprocal interdependence of his drive for self-actualization and the claims made upon him to be a loving and responsible member of a community of fraternal regard ever widening toward unlimited inclusiveness;
8. the individual on occasion has a deep and heartening feeling responsive to the beauty to be experienced both in the world and in the works of man;
9. the individual in acknowledgment of his solitariness and his dependence seeks to transcend his immediate self through meditation, contemplation, worship and artistic creativity in

[10] See his *Religion in the Making*, p. 85, The Macmillan Co., N. Y., 1926.

[11] Quoted by Sir Richard Livingstone, *Atlantic Monthly*, March, 1953, p. 41.

[12] See in this connection *Religious Values in Education*, by Ward Madden, Harper & Brothers, New York, 1951; *Intelligible Religion*, by P. H. Phenix, Harper & Brothers, New York, 1954; *Living Religions and a World Faith*, by W. E. Hocking, The Macmillan Company, New York, 1940.

order to have a feeling of oneness with a larger reality which is often felt to have attributes of the holy;

10. the individual has a compulsion to discover and augment what is valuable for him, an urge which may rise to the pursuit of Godlike values as experientially revealed;
11. the individual unhappy in facing his own perversity, resistance, hatred, cruelty, (his sinfulness) tends to seek restoration, desires to get back into "the good graces" of himself and the community against which he may have offended; and he may have an experience of "redemptive love," of being recovered to feeling *at one* again with the wholesome desires of his nature;
12. the individual has an immediate experience of having to bear the burden of responsibility for exercising a genuine and sufficient, albeit limited, freedom—that is, the need to exercise certain choices in thought and action; indeed it is the reality of this freedom which makes possible his creativity, his moral effort, his self-actualization;
13. the individual comes gradually to grasp the imperative claim in the nature of things summoning him to fulfill in appropriate ways all the other components or modes of challenge and response included in this enumeration. This imperative claim he is free to deny; yet also as he strives to realize it and to achieve in his several modes of response, the results will, of course, be forever *relative*. Neither effort nor outcome can be perfect. Yet the ideal injunction remains as innately and attractively propulsive, "Be ye therefore perfect."

Surely the several key symbolic words here suggesting attributes of religious feeling which in their totality are qualitatively pursued, come close to characterizing *a religious way of life*. They are: creativity, flux, permanency, aloneness, dependency, tranquility, orderliness, community and fraternal love, beauty, meditation, value, restoration (or redemption), freedom, an innate imperative.

As the individual can in good faith, good will and good mind seek to weave these components freely into his experience, he is living the religious life; he is sharing religious experience. And thus in a discerning view we find life demanding a kind of dedication which removes it from the perfunctory, from the meaningless and from the secular. Life thus enjoins upon man a career which has *natural sanctity*. And in seeking to achieve that natural sanctity he partakes, up to the limit of his powers, in a *transcendence* of his little selfhood. His natural life, when thus aware and committed, and when it is infused with such upward and transcendent thrust, conjoins the human with the divine. It is thus that man in his humanness, but with his transcendent predispositions and the imperative in his nature, attains the realization of the unutterable mystery of man in God and of God in man. This may well be the deeper meaning of such inscrutable words as, "Now we see through a glass darkly, but then face to face." "It doth not yet appear, what we shall be, but we know that when He shall appear (namely, the vision of the Good Man), we shall be like Him for we shall see Him as He is." "We know in part and we prophecy in part, but when that which is whole is come, that which is in part shall be done away."[13]

My central thought in this entire discussion, is that it is possible and desirable for more individuals—especially educated persons—to come to self-awareness about these component insights into human qualities of profound significance and values; and having attained such awareness, to realize their potential for directing men to the claims their own natures make upon them. Such insights and such realizations do not inevitably need the idiom of institutional religions, even though most of the moods are further expressed and interpreted in the traditional orthodoxies. The truly religious undercurrent of a teacher's life outlook might thus, almost inevitably, infuse his personality and permeate his teaching. Deeply conceived, the separation of the secular and the religious is artificial. Education partakes of this true religious quality wherever the teacher—irrespective of his affiliations—is possessed of spiritual insight and commitment. Let the separation of church and state by all means remain a cherished conviction; but also let us have on the part of more teachers a deeper philosophic grasp of what moral and spiritual values are, and how they are to be realized in the ordinary walks of life.

VIII

IN conclusion, I return to my introduction in which emphasis was placed on the difficulties in the way of the study of man and the elusiveness of our knowledge of him in its totality. To this end five aspects of the educational process were characterized in point of their promise in relation to the task confronted. The underlying theme has been some effort—philosophical in its roots—to see the possible content of study at the college level as potentially *hanging together*, in some more coherent and integrated view than is now typical.

College education is now as never before in a strategic position, given more thoughtful insight by more teachers, to advance its necessary and overdue attack on this whole problem. The answers and proposals should undoubtedly be diverse. But to offer for public conversation one considered attempt in this direction may have some provocative value.

For higher education stands profoundly in need of a philosophic orientation which will give greater unity and penetration to the grasp of the nature of man upon which its instruction is fundamentally focused.

[13]Support for this whole approach is well expressed by S. Radhakrishnan in *Recovery of Faith*, Harper & Brothers, 1955, see pp. 199, 203.

EXPERIMENTS IN INTEGRATED EDUCATION:

The Teaching of Chemistry in High School and College

THREE articles in *The Journal of Chemical Education*[1] can be brought together and summarized to indicate a degree of integration which is possible in the teaching of chemistry in high school and college. These articles are: (1) "The Nature of Science and the Teaching of High School Chemistry," by George P. Klubertanz, S.J., of Saint Louis University, in the May 1955 issue of the *Journal,* (2) "Trends in High School Chemistry," by Dorothy W. Gifford of the Lincoln School, Providence, Rhode Island, and (3) "Simulated Research for Freshmen," by R. K. Summerbell, Gregory Lestina, L. Carroll King and H. M. Neuman of Northwestern University, Evanston, Illinois. The latter two articles appeared in the September issue of the *Journal.*

All three articles indicate a trend away from the "cook-book" method of teaching chemistry. Miss Gifford confesses that it came as something of a shock to her to discover ". . . that 'getting through the book' was not real college-preparatory teaching." This began when some of her pupils went up for College Entrance Board Examinations and were shocked to find that the examiners had dared to ask questions which "were not in the book." "We have learned," she says, "that the [college] freshman course in chemistry offers little hope for the student who has excelled simply through the memorization of facts, that unless he can use those facts in new and different situations he is doomed to grades of C or lower."

In her course, as in others known to her, Miss Gifford says, ". . . we are gradually coming to teach less factual material, but [that] we are demanding in its place a greater understanding of the chemical principles illustrated by such factual material; [that] we are trying to make the student use the facts and principles he knows in meeting new situations in an intelligent fashion; [that] we are trying to make his laboratory work less mechanical, more thoughtful, more honest and more intelligent." This is on the high school level. The same trend in college chemistry courses is shown by the team from Northwestern University, who indicate that ". . . in many colleges and universities it [qualitative analysis] has been absorbed into the elementary work and has almost disappeared from the curriculum as a separate course. In schools where this transition has occurred, the gain in student interest and morale in the elementary laboratory has usually been pronounced."

Klubertanz concurs by saying, "It is a common—and often justified—complaint of graduate teachers of science that students, at the beginning of their graduate work, need to unlearn much of what they had previously learned." This indicates several very important things. As confessed both by the high school teacher and by the undergraduate teachers just quoted, something has been wrong in the teaching of elementary science courses. In part, this is cook-bookery. In another part, there seems to have been a misapprehension of science even on the part of teachers and curriculum-builders. What is needed (and what these papers indicate is already being attempted in many quarters) is a method of teaching science which will present it as an *integrated whole* from first introduction to graduate work. If this can be accomplished, then the matter of "unlearning" or "relearning" will be solved—and the serious moral and social consequences of such a state of affairs will be eliminated. What is more, the valuable time of the student will not be wasted and the end-product of knowledge both as to quality and quantity possessed by the future scientist and citizen will be greatly enhanced.

Not only must the individual subject matter area (chemistry in this case) be integrated through the school and college experience but, even more importantly as Klubertanz says, "The analysis of the nature of science cannot legitimately be made apart from a clear and careful inquiry into the whole scope of human knowledge." Such a point of view maintained throughout our schools and colleges would go far toward placing science in its balanced and proper perspective and proportion in the curriculum as a whole. This in turn will result in science's having its appropriate place in the conceptual framework of the citizen-graduate of such schools and colleges—a value highly to be desired now and in the immediate future.

Miss Gifford's formula for her course is one that ". . . puts first things first, and lets the descriptive details take their proper place." Klubertanz states that ". . . Any scientific knowledge has as its starting point a careful and detailed observation of the data that are pertinent. Hence, we must sharpen the notion of *observation.* The kind of observation proper to science is that of experimentation . . . Basically, experimentation does not wait for nature to show itself, but puts

[1] Scripps Institute, La Jolla, Calif.

the natural object in such a condition—asks a question, as it were—that it must act, or else show its nature in not acting." This is exactly the point made by the Northwestern University team which has given a new lease on life to freshman laboratory chemistry by simulating research instead of requiring the student to repeat experiments ad nauseum and come out with the results indicated in the handbook. "Mediocre students, slavishly following directions, are too often able to achieve satisfactory grades without ever doing any real thinking" they tell us, and continue, "At no point [under the old system of laboratory work] is the student forced to make a real choice as to what he should try next. The making of a correct choice as to the next step is not only a lot of fun for the potential chemist, but the ability to do so is probably the principal characteristic of persons who eventually become outstanding as research men."

Here, we have the nub of the problem of teaching any subject integratively: Whether we acquire a few basic definitions and move from there to a mastery of the theoretical concepts behind the periodic table of elements in chemistry (as in the syllabus of Miss Gifford) or whether we "put first things first" by providing any other program of concepts and laboratory experiences, it is important that the embryo scientist learn early and hold in mind continuously the nature and relative importance and place of "method and technique, fact, law, and theory" which, according to Klubertantz, "are the essential elements in modern science." "Many people," he observes, "seem to think that a fact in science is the simple, total reality of a thing or an event as it actually occurs. Scientists realize that this is not the case. Experience as such is both too rich and too poor; too rich, for it always contains a multitude of sheer contingencies and irrelevancies; too poor, for as it comes to us without interpretation it often is no more than a brute signal that something is going on."

The method being advocated by all of these teachers is that facts as such be used to illustrate concepts and theories, that concepts and theories shall always illuminate facts and observations, that experience (action) shall proceed hand in hand with learning, and that the student shall come to realize that the questions one poses to nature are of far more importance than the answers one may have.

What are the results of such integrative teaching? Klubertanz tells us that "Students who grasp these distinctions [between fact, law, theory, etc.], and who have, even at the introductory level, the beginning of an understanding of law and theory will profit a great deal. Future scientists will remain open-minded and creative if they realize the nature of the generalizations and theories they have learned. Yet there is a core of fact and law that they can reasonably be required to learn and even memorize. We can train them in carefulness in experiment, in accuracy and objectivity in reporting without closing their minds. Future nonscientists also can acquire a basic understanding and respect for science. . ."

The Northwestern University team reports that, upon the introduction of their program of "simulated research," "The students went to work with enthusiasm and the instructor experienced one of the most thrilling episodes in his teaching career. Laboratory note-taking was no longer a chore that an unreasonable teacher insisted upon, but a perfectly logical and necessary aid in arriving at an objective. Accurate laboratory observation was of vital interest to the individual student." Regarding some minor loss in content covered (as compared with the traditional method of teaching) they comment, . . . "this is a small price to pay for the enthusiasm generated, and for the very real understanding of the specific nature of the qualitative scheme and of the general nature of scientific procedure. Best of all, the students are given some small indication of the *excitement of experiment.*"

Commenting on the modern American high school student, Miss Gifford observes that ". . . their difficulty is different from the American tendency of using ready-made thoughts like cake mixes; there seems to me to be a genuine unrest and uncertainty which makes school life seem less important than it used to." But the picture is not by any means dark, she assures us for ". . . there has been and is a steady growth, at least on the part of the young people with whom I come in contact, in enthusiasm for using the mind in a reasoning process. A class which slogs along with an ordinary memory assignment goes by leaps and bounds when being led into new concepts by deductions drawn from former experiences. . . They rise more readily to the bait of the 'thought' question than they did five years ago, and they glory in the sense of power which such successful reasoning gives them."

In the face of a shortage of scientists let us hope that these integrative methods will not only turn out better trained chemists but graduates for whom learning, thinking and knowing generates enthusiasm. Unfortunately, most teachers of chemistry are still held down by the lack of text books which are constructed along the line needed for this method. What is even worse, most high school chemistry teachers, because of the pressures upon them, must "slog along" with laboratory manuals and workbooks which successfully prevent the originality, self-reliance, and thinking which the teaching of chemistry either by the conceptual approach or by the simulated research method make so vitally important.

We are in search of material for high school physics and general science programs which parallel those discussed here.

—Harvey W. Culp

The Progress of Integration in English Education

"THE Purpose of University Education" was considered editorially in the October 15, 1955 issue of *Nature,* in reporting on the Conference of Rectors and Vice-Chancellors of European Universities last July in Cambridge, and on the subsequent meeting of the British Association for the Advancement of Science at Bristol. Both of these meetings discussed the importance of general education and the need of securing more breadth in training the scientist, or indeed any type of specialist, but neither could report much progress in suggesting means of securing it. At the Conference the means generally favored to achieve a balance between specialization and general culture were optional courses in subjects of general cultural interest, or a general course designed more specifically to prepare the student for his specialized courses, both suggestions recognizing the importance of deepening the student's understanding of his own special subject in the context of a wider background. However, the editorial notes with regret that the discussions seemed to lack either real unity or the note of urgency which might stimulate positive action.

It was notable, moreover, that the Conference did not touch upon the relationship of the secondary schools to the universities, or suggest that the foundation for general education should be acquired in the schools. In August there appeared a report of the subcommittee appointed two years ago by the Committee of Vice-Chancellors and Principals to consider and make recommendations in regard to university entrance requirements in Britain. This report made it clear that there is little unanimity on matters of importance to sixth-form school and first-year university teaching, the divergence in points of view being mainly concerned with the necessity of maintaining present requirements of prescribed subjects, on the one hand, and the responsibility of the schools for general education, on the other. The report drew this editorial comment from *Nature*:

"If its members had been really convinced of the importance of general education, either for the specialist or the ordinary citizen, it is difficult to believe that such relatively small points could have kept the two sides apart . . . The means will be discovered when it is believed that the end really matters; and if the universities are really interested in discovering the state of the general education of their students at the time of admission, they will not be prevented from ascertaining that state even if it is necessary to devise an entirely fresh means of doing so."

The discussion of the British Association at Bristol indicated a far greater disposition to re-examine the underlying issues, both by schools and by universities. It was taken for granted that a fully educated man should possess both the deep insight into human nature that is acquired from the written record, and the first-hand experience of human actions to be gained from deep and practical immersion in human affairs. Sir Philip Morris, in opening the discussion, agreed to the importance of the non-scientist having some understanding of the scientist's outlook on the physical universe and of general education for the scientist. Many of the speakers recognized the importance of close and new ways of co-operation between school and university, and realized that suggestions thrown out must be put to the test. The responsibility of the school for general education was emphasized in several ways, it being argued that the school's function is to stimulate curiosity, to develop the critical faculty, and impart some understanding of the scientific attitude and method. "If this achieved," says the editorial, "the ordinary sixth-former should acquire exactly the basis for his general education that he needs as a citizen of this modern world, whether he follows a scientific career or not." Several of the participants felt that it is possible to build around physics as a major component an education as deeply and widely stimulating as that provided by the "Greats" and "Modern Greats" of Oxford. The editorial continues:

"There is thus much more reason than the report on University Entrance Requirements itself implies for believing that the schools and the universities of Britain are ready to come together in this matter, and to contemplate even drastic changes if necessary. The addresses and discussions at Bristol have made clear to a wider audience that the educated man today—and even more in the next two or three decades—must have a clear understanding of the outlook and method of science . . .

"Mr. Wolfenden is clearly right in holding that we should seek not to give the same kind of education to all but, recognizing the differences between people, to educate them rather according to their ability, age and aptitude. [See MAIN CURRENTS, November, 1955, page 43, for discussion of Mr. Wolfenden's thesis.]

"To do this might go far to assist in the adjustments that will be called for if we are to provide, not merely the educated men and women . . . but also the ordinary citizens who are capable of taking intelligent decisions in the many affairs of local or national politics in which scientific and technical issues are involved. Those adjustments, moreover, are unlikely to be made unless the objective is recognized as fully worth while, and education is seen as an inter-related whole.

". . . Those who insist most strongly on the importance of a general education for the scientific specialist, or of some understanding of the outlook

and achievements of science on the part of those not entering on a scientific career, are not advocating any relaxation of university standards. They are, on the contrary, suggesting that university practice and standards should be adjusted to take closer account of the advances in human thought and experience which science has made possible. . . The technique of teaching itself requires adjustment, and the scope of university work must have regard both to the changes in the schools and in the level of education of the adult population.

". . . The nature of the university's contribution to the training of men and women to serve the community, to the equipment of the adult citizen to meet the needs of the modern world, may well need re-examination, and also the methods used to make that contribution; but it is above all essential that we should keep in mind that supreme function of the university as a community dedicated to the search for truth and the fearless communication of ideas.

"In this sense the universities can never abdicate their responsibilities for leadership in the community without endangering their own existence. It is not simply that the community looks to them to give some broad indication of the implications for human thought and living of advances in knowledge and changing technologies . . . The community needs centers of independent thought and criticism, in which the value of international interchange of thought is clearly demonstrated, just as much as it needs institutions to provide it with the fully trained and really educated men and women capable of handling alike the scientific and technical problems of government and industry and the human and social issues that are also involved, and to provide the new knowledge upon which the advance of science and technology depends. It needs chiefly, however, men and women who are both able to draw imaginatively on past human experience, and are no less competent to face the future with vision, with understanding and courage, and to fashion and create the new institutions and new loyalties that changing needs demand. If that is to be done, the creative thinking and experiment must begin within the university itself."

—E. B. Sellon

Developing a Climate for Genius

DR. Sidney L. Pressey discusses one of the most important aspects of the educational programs in an article entitled "Concerning the Nature and Nurture of Genius" which is found in *The Scientific Monthly,* vol. 81 no. 3, Sept. 1955, p. 123-129.

The author says that "there has been relatively little consideration of whether present educational programs are best suited to the needs of our most brilliant young people. Superior abilities are now generally considered so predominantly a product of innate constitution that certain 'educational' factors, possibly of very great importance in the growth of such abilities, are overlooked. It is sometimes well to get outside of current habits of thought and try to look at a topic in a reappraising way."

Dr. Pressey asks two questions: why should there have been such a rash of notable precocious musicians in the Europe of a century or more ago and so many youthful athletic champions in this country now; and how, in such favorable total situations, have these prodigies come about. In a study of the careers of many musicians and athletes, the author found five common elements: "(1) Precocious musicians and athletes usually had excellent early opportunities for the ability to develop and encouragement from family and friends. . . (2) Usually individuals who developed precocious excellence had superior early and continuing individual guidance and instruction. . . . (3) Precocious individuals have had the opportunity frequently and continuingly to practice and extend their special ability and to progress as they were able. . . (4) The special precocious ability usually brought a close association with others in the field, which greatly fostered the abilities of all concerned, and led to a still wider stimulating acquaintance. . . (5) As a result of many opportunities for real accomplishment, within his possibilities but of increasing challenge, the precocious musician or athlete has had the stimulation of many and increasingly strong success experiences—and his world acclaimed these successes."

Dr. Pressey's thesis is that "too much stress has been put on presumed extreme constitutional genius and too little on a concomitance of favorable factors, operating in the growth years . . . In this connection, Wechsler's argument may well be recalled—that the range of human physical traits, as in height, strength, and quickness, are really not great, and that the range of mental capacity may be less extreme than is usually supposed."

Some of the influences that hamper the precocious child are: "The general public tends to regard the intellectually gifted small child as a freak"; mass education and indifference to the needs of the gifted result in almost none of the individualized guidance and instruction that was mentioned as "an important element in the rapid development of precocity in music and athletics; . . . opportunities often are entirely lacking for a youngster to indulge intensively and continuingly an aptitude in such a field as a science, advancing as he is capable . . . Nor can the broadly gifted and precocious youngster advance in his total school program more rapidly than the average; acceleration is, in most schools, considered unwise."

Dr. Pressey makes suggestions concerning the educational process and the social climate that he feels will work toward more and better American geniuses. He proposes that every school and college should have a person who coordinates special programs and

who scans each entering student's record for evidence of superior abilities. Such persons would "try cumulatively to build community interest in and opportunities for these ablest young people, as through the local papers and service clubs. . . Slowly, they might change public attitudes to interest in the intellectually, as well as the athletically, able. Surely no position could be more finely rewarding."

Other suggestions for better methods are: "admission to the first grade on the basis of readiness for school rather than chronological age, replacement of the first three grades by a 'primary pool' out of which children would move early or late depending on when they finish primary work, rapid-progress sections doing three years' work in two in junior and senior high school, and credit by examination in college.

"Not only are accelerates usually successful and happy in school, but they are more likely to complete collegiate and advanced training . . . Further, accelerates seem more often successful in their careers than individuals proceeding through their education at the usual pace." Dr. Pressey provides the statistics that amply support these conclusions.

"To produce persons of notable accomplishment, educational efforts should be directed straight toward that goal, in the light of all that can be found out about such persons and their upbringing."

—Ruth Lofgren

Ecological Concepts

THE scope, methods, and major concepts of ecology are reviewed by Dr. Lee R. Dice in an article entitled "What Is Ecology?" that appeared in the June, 1955 issue of *The Scientific Monthly* (p. 346-351).

As the author reminds us, all science is interrelated. "Ecology has intimate relationships with many other branches of biology, with certain of the physical sciences, and with numerous phases of social science. Any attempt to draw boundaries between these closely related sciences will do more harm than good. Every ecologist, like every other true scientist, must be free to pursue his investigations wherever they may lead, without hindrance from artificial boundaries among the sciences."

Dr. Dice discusses a few of the concepts in ecology that he feels have the greatest significance. "One of the major concepts of biology is that living material is organized at a number of levels of complexity. Particularly important levels of organization . . . are represented, first, by the individual organism; second, the species; third, the social group composed of members of a single species; and fourth, the community composed of several to many species of plants and animals. Each of these units of organization has its own special relationships to its environment."

The second concept the author deals with involves energy relationships. "The maintenance of life requires the constant expenditure of energy. Practically all the energy that is utilized by living organisms is derived directly or indirectly from the sun in the form of light and heat . . . The resulting food chains within an ecologic community are usually very complexly interconnected."

The ecosystem is one of the most useful concepts in ecology and is the interacting system formed by each community, together with its physical habitat. "In part, the habitat controls the species of organisms that can exist in each particular situation and thus it plays a large role in determining the kind of community that can develop there. The community, however, interacts with and modifies in such a way that this often becomes more suited to support the community."

The author explains that the ecologic balance between the individual and its habitat has been called homeostasis and that a similar ecologic balance is maintained between every community and its habitat. These are always dynamic balances.

In a discussion of reproduction, Dr. Dice says, "Communities, as well as individual organisms, are subject to mortality, owing to environmental pressure or competition from other communities. New communities may arise through the expansion of existing stands and the later loss of connections between certain of their parts . . . New communities also may arise through the formation of new aggregations composed of the proper member species."

The concept of ecological succession is also discussed. "When competition occurs between two communities that differ in type, one community is likely to displace the other." The author also explains variability of communities, ecologic patterns, individual adaptability, and evolution. "Through evolutionary changes in their psychology, many species of animals have acquired the habit of cooperating with their fellows . . . social behavior produces special relationships between organisms and their physical and biotic environments and, consequently, involves at least in part the ecology of the situation.

". . . The science of ecology occupies a strategic central position among the biological sciences."

The author concludes with a discussion of the application of ecologic principles to human affairs. He knows how primitive man had to be an ecologist, at least to some degree, if his hunting and fishing were to be successful. Also, pastoral and agricultural men were dependent upon ecologic knowledge for raising domestic animals and for growing crops. We are reminded that modern man, too, is dependent for his continued existence on the productivity of the lands and waters of the earth. "Practical ecology consequently forms the basis for every human community no matter what its stage of culture."

In conclusion Dr. Dice urges all ecologists to give serious consideration to the basic concepts of ecology. "The vital part of ecology consists of its natural laws, theories, and hypotheses."

—Ruth Lofgren

Research in Photosynthesis

ONE of the most exciting developments in biology in recent years concerns the carrying out of complete photosynthesis outside the living cell with the use of isolated chloroplasts. This is discussed by Daniel I. Arnon in the July, 1955 issue of *Science* in an article entitled "The Chloroplast as a Complete Photosynthetic Unit."

The author reminds us that "chloroplasts are the cytoplasmic structures in which the complete photosynthetic process is carried out, both inside and, under suitable conditions, outside the living cell." The process of photosynthesis has been known for almost 200 years, and the fact that chlorophyll is essential for the process has been accepted since 1865 when Sachs showed that "no cell assimilates so long as it possesses no green chlorophyll, but does so as soon as it is provided with it."

Dr. Arnon traces the history of extracellular photosynthesis. He shows how the intellectual climate in which a scientist works influences the assumptions he makes and the kinds of questions he sets out to answer. In discussing the modern period of research on photosynthesis, the author says, "The spectacular advances of biochemistry in elucidating the nature of fermentation and respiration by means of extracellular reactions . . . the recent reconstruction of the principal events in the citric acid and fat oxidation cycles, and many other developments left no doubt that, in principle, photosynthesis, like any other cellular process, should be susceptible of study outside the cell. What was lacking . . . was . . . a quantitative biochemical technique for the separation of the photosynthetic process from other complex metabolic activities that occur simultaneously in an intact cell."

The author explains that the research on extracellular photosynthesis has utilized two different techniques: the first deals with isolated chloroplasts; the second, with preparations of whole cells without regard to any special subcellular structure. The author limits his review to those experiments that measure extracellular photosynthesis in terms of oxygen evolution or carbon dioxide fixation. (Other methods that may be used are: determining changes in oxidation-reduction potential and hydrogen ion concentration of whole-leaf macerates and chloroplast suspensions.) The results of many experiments are described as the author shows the development of the scientists' insight into the process of photosynthesis. Anyone who has had some training in biochemistry will find this most interesting.

"In the light of our present evidence, chloroplasts emerge as remarkable complete cytoplasmic structures, which contain multienzyme systems divided into three main groups, each controlling an increasingly complex phase of photosynthesis: photolysis of water, photosynthetic phosphorylation, and carbon dioxide fixation." The author believes that the separation of the chloroplast as the "photosynthetic unit" will prove to be a fruitful approach to the study of the detailed mechanism of photosynthesis.

Dr. Arnon describes the most interesting properties of extracellular photosynthesis found so far to be: "total independence of photosynthesis from respiration or from any other process that requires the consumption of molecular oxygen and . . . direct conversion of light energy into phosphate bond energy by an anaerobic process." Some of the unsolved problems now under consideration are: "The nature of the reductant in carbon dioxide fixation, the path of carbon in the formation of sugars and starch, the identity of other cofactors, and the quantum efficiency in photosynthetic phosphorylation."

The author concludes with a quotation from Green on the reconstruction of metabolic sequences outside the cell. "Once an *in vitro* system can be found in which a metabolic sequence can be shown to proceed, at least one can be certain that all components needed are present in that system, and by the stepwise simplification and analysis of the system, it is only a question of time, patience, and ingenuity before the entire process is fully reconstructed."

—Ruth Lofgren

The Search for Wisdom: Disciplinary Interaction

IN an address delivered at Harvard University on October 21, 1955 (noted in *Science*, Vol. 122, No. 3177, Nov. 18, 1955), Prof. I. I. Rabi called for a greater understanding between scientists and humanists to combat a growing mood of anti-intellectualism.

Prof. Rabi notes and deplores the current tendency to reject science, one of the greatest achievements of the human intellect, because it lists the hydrogen bomb among its many achievements. For this specious reason science and the intellect are held to be false guides, and hope and salvation to be sought elsewhere. At the same time, the necessity of keeping ahead of the Russians is ever-present, so that people are forced into the position of wanting to "keep the fearsome fruits but neglect the spirit of science." This, Prof. Rabi feels, "can only hasten the destruction which . . . people fear. Anti-intellectualism has always been endemic in every society.

"What people are really looking for is wisdom . . . knowledge plus a quality which is within the human being. Without it knowledge is dry, almost unfit for human consumption, and dangerous in application . . ."

The humanities must be cherished because they preserve and create values; they contribute the historic achievements of the human spirit and discern a vital part of the life of man. But it is impossible to neglect the fact that in order to learn to understand himself man must also learn to understand the universe.

"To my mind the value content of science or literary scholarship lies not in the subject matter alone . . . It lies chiefly in the spirit and living traditions in which these disciplines are pursued. The spirit is almost always conditioned by the subject. Science and the humanities are not the same thing; the subject matter is different and the spirit and tradition are different. Our problem in our search for wisdom . . . is to blend these two traditions in the minds of individual men and women . . .

"Wisdom is by nature an interdisciplinary quality and not the product of a collection of specialists . . . The greatest difficulty which stands in the way of a meeting of the minds of the scientist and nonscientist is the difficulty of communication, a difficulty which stems from some of the defects of education. The mature scientist . . . can listen with pleasure to the philosopher, the historian, the literary man or even to the art critic . . .

"Unfortunately this channel of communication is most often a one-way street. The nonscientist cannot listen to the scientist with pleasure and understanding. Despite its universal outlook and its unifying principle, its splendid tradition, science seems to be no longer communicable to the great majority of educated laymen . . .

"The problems are, of course, depressingly difficult. There are firstly the problems connected with the secondary schools — their over-crowding; their teachers, overworked and inadequately trained; the school boards; and not least the powerful clique of professional educators who form a society within our society. All that is unique and characteristic of science and mathematics is being crowded out of the curriculum and replaced by a fairy tale known as general science . . .

"Wisdom can achieve a hybrid vigor by crossing the scientist and the humanist through a more extensive and intensive interaction within the faculty. Why should not the professor of physics be expected to refresh himself every seven years . . . by taking a course in aesthetics, comparative literature, or the Greek drama? Why shouldn't the professor of medieval philosophy or the professor of ancient history take a course in modern physics and become acquainted with the profound thoughts underlying relativity and quantum mechanics? By taking in one another's wash, we might all become cleaner and more wholesome."

—E. B. Sellon

NEWS AND NOTES

Benjamin Franklin, 1706-1790
Doctor Honoris Causa,
Yale, Harvard, Oxford . . .

"The nation that has the schools has the future. . . Knowledge; most potent of weapons. . . Manhood, not scholarship, is the first aim of education."

IN his *Autobiography,* Benjamin Franklin, the author of the above-quoted remarks, tells us that of formal education he had "at the grammar school not quite one year," from eight to nine, and about a year, nine to ten, in "a school for writing and arithmetic, kept by a then famous man, Mr. George Brownell." By good fortune for all Americans his father, a candle maker and tallow chandler, apprenticed Benjamin to a printer.

To that trade, and to the times, the place and the lad's character, we may credit the outcome: that those two years of schooling were, of schooling, enough to bring him degrees from Yale, Harvard and Oxford, membership in the Royal Society and other honors in the field of learning.

Two hundred and fifty years after Franklin's birth, the American school system which he did much to inspire is torn within by a debate which suggests (to some) that it requires drastic revision. Certainly the system is a spectacular complex; and certainly the vital institutions which depend upon it and support it—the family, industry, government, farming, the law, the church, and the Funding Foundations—are threatened by its acknowledgedly unsolved problems. Yet in spite of this all of us, without exception, are convinced that this free, universal system of education is the indispensable foundation of our democracy.

This being so, what was Franklin's philosophical secret, that two years of formal schooling were enough for him?

The autobiography reveals it. It shows that he was not a man of moods or excessively emotional introspection; yet it would be hard to find someone equal to him in those powers of impersonal self-examination which must be devoid of brooding or confused psychologism if they are to have effect. Today, if someone has troubles he is apt to go to a psychiatrist or analyst, a man or woman likely, in turn, the product of psychotherapy, and so on up to Freud who, himself, might have been cleared by Groddeck.

Franklin undertook sole responsibility for himself, without reliance upon any institution, not even the church. Yet he had as vast a respect for spiritual truth as he had for practical knowledge and useful invention, which latter we see in the Franklin stove, bifocal

eyeglasses, and all the rest of it; as deep a love for truly religious men as he had a tolerant penetration into the hollow heart of a pietistic fraud. He was not a recluse, nor a man self-made at the cost of others. On the contrary he was sociable, socially responsible, the devisor of the lending library, the volunteer community fire brigade, a responsible night watch system, a college now become that giant, the University of Pennsylvania.

The story needs no recounting here. We want only to ask *what was knowledge to him,* that he could be a first-rank experimental scientist, a man of letters, a humanitarian, a patriot-rebel, and in general a thoroughly rational mind and a moral and spiritual force?

The answer is quite plain: in common with many men of his time, but far beyond most of them and most of us, in both conviction and conduct, he understood that the universe is so orderly and its harmonics so subtle that it is capable of giving men freedom (when demagogues and tyrants have been fended off), granting each of us a sacred uniqueness (which school can well-night obliterate), and yet doing justice to every man, marking even a sparrow's fall. We, of course, know more about the facts and working of nature's harmonic orders than Franklin could know. But we understand, accept, and act upon them as free and unique and self-responsible individuals, much less than he did. Our school system does not do for children in secular terms what that great secularly-minded religious man did for himself. He *knew* he was alone and on his own with Providence; and so he was as prudent, as provident, as generous, as just, as humane as he could possibly be, modelling his life upon that Source.

With money, our country is generous to its vanquished enemies, and its technologically less well advantaged contemporaries. But it is not wisely generous to them or to its own children. From the White House Conference to the latest plain and generous Ford grant of millions, the educational emphasis is upon prudence as money, as buildings, even now and then as salaries. This is all very well, but what of some relatively modest expenditures to restore to the citizen a firm foundation through education, so that he will have Franklin's working knowledge—immensely enhanced by all that modern exact science can afford—of the meaningful universe? Would not all Americans be better off in life if, upon their demise, they might have said of them what, after innumerable revisions, Franklin last wrote for his own epitaph?

BENJAMIN FRANKLIN
January 17, 1706 — April 17, 1790
Boston *Philadelphia*

The Body of BENJAMIN FRANKLIN, *Printer*
(Like the cover of an old book, its contents torn out, and stript of its lettering and gilding), lies here food for worms. But the work shall not be lost, for it will (as he believed) appear once more, in a new and more elegant edition; Revised and Corrected by *The Author.*

THE first issue of a new Scandinavian Review of Sociology, *Acta Sociologica,* has been received. Although it is designed to further sociological research in the Scandinavian countries, the journal is specifically intended to reach an international audience and acquaint a wider public with developments in Scandinavia, and for this reason articles printed appear in English, German and French.

The Editorial Board, which includes Sverre Holm (Chairman), University of Oslo, Norway, Torgny T. Segerstedt, University of Uppsala, Sweden, Karl O. Christiansen, University of Copenhagen, Denmark, and Heikki Waris, University of Helsinki, Finland, state their aims in part as follows: "The new periodical is to be an organ for mutual information and communication and in this way try to create a richly faceted unity of what is now many different research interests. Because of our remote geographical situation, our languages, the lack of an academic tradition within sociology, there is a certain risk that the results of Scandinavian research will be overlooked in the international discussion. In our opinion we may often make contributions to the scientific discussion of such a value that they ought to reach a wider public than the one in our linguistic area . . . The *Acta Sociologica* is intended to make itself heard in the international discussion . . . a scientific periodical which is intended to increase Scandinavian collaboration and make the voice of Scandinavian research heard outside Scandinavia; but we also hope to be able to strengthen the position of sociology within our Scandinavian countries."

The first volume is dedicated to the memory of Theodor Geiger, and is devoted to a representative selection of his writings.

Acta Sociologica will appear quarterly. Subscriptions, by one volume only, are 32 danish dr., and may be ordered from Ejnar Munksgaard, Norregade 6, Copenhagen, Denmark, or from any international bookseller.

THE Fall Meeting of the Society for the Scientific Study of Religion, at Harvard University, featured addresses on religion from the point of view of a psychiatrist by H. A. Murray; an anthropologist, Clyde Kluckhohn; a sociologist, Talcott Parsons; a natural scientist, Philipp Frank.

The Spring Meeting is to be held in New York City on April 21, the chief theme being "The Ministry as a Profession." There will be room on the program for a few unsolicited papers, preferably though not necessarily on this theme. Three copies of an abstract of *not more* than 300 words should be sent to the Chairman of the Planning Committee, Charles Y. Glock, Bureau of Applied Social Research, Columbia University, New York 27, N. Y. before March 15.

REVIEWS

Life, Art, Reason and Reality

IN *Icon and Idea,* subtitled the "Function of Art in the Development of Human Consciousness," Sir Herbert Read continues the masterly discussion of life, art, reason, and reality for which we have long been in his debt. (Harvard University Press, 1955, 152 pages and index, $7.50). Here he pursues the relation of the images developed in consciousness, and projected (in art) by the affective impulse, to the ideas which arise from the mind's reflection upon image and impulse. Eighty-seven choice and telling half-tone plates represent nearly every major mood in graphic, plastic and building art, from a cave near Cabrerets in France to modern constructions projected in 1953 in a civic center in Boston. Cassirer and "the neglected works of Conrad Fiedler" are the starting points.

Readers of his *Education Through Art* (Pantheon Books, New York, 1945, 2d. ed.) were afforded some of the most wholesome and needed discussion of man's mental resources (pp. 104 and 106-7), modern art and the art of the past, in terms of naturalism, superealism and other moods (97-98), nature and natural neutrality (16-20). From that volume one was tempted to quote whole pages, especially deep in the discourse (296-298) when the humanity of the author wells up from the depths of enlightened indignation. We find here the same sustained vigor, penetration and feeling.

Sir Herbert is concerned about mankind, about freedom, about reality, and he commands all the knowledge he needs of language, art and historical resource. He is struggling—strongly and confidently—amid the great tides of science, art, philosophy, and living, historical forces, always pushing ahead through the shallows of aestheticism toward firm reality. The writing may be actually analytical, as when he discusses Leonardo (page 101, and after). It may not always be well organized (Chapter V). But it is always the eloquent and imaginative consequence of a sense of the whole of existence. It is always about humanity, about meaning, the drama and mystery of man's being. We cannot do better than cite a representative passage, in which this command of psychology, science, and sense of significance will be felt:

"If I may use an image myself, human consciousness has been represented in this argument as an octopus of unimaginable dimensions with tentacles ever weaving through the surrounding elements, searching and advancing everywhere, twitching and withdrawing when danger is sensed, but gradually mastering its environment, gradually increasing the range of its knowledge and activity. At the end of each tentacle is the sensitive, image-forming perception of the artist. To complete the image, one must think of our monster as proceeding in a definite direction, towards some goal not fully realized, animated by some instinct for a fuller and securer life.

"This creature has now moved into a new habitat—no longer a habitat of horses and carriages and Newtonian cosmology, no longer a habitat of dark cavelike houses and aristocratic patronage—but a world of electric energy and relativity, of glass and steel, of speed and democratic uniformity. The artist has helped to create this brave new world—with his images. He now moves on towards another and still braver world, and he has the present task of creating images that will adumbrate this world, make it imaginatively conceivable to the alert mentality of modern man. How shall he do this? With images of the past—the Greek image of ideal man, the Gothic image of a transcendental God, the Renaissance image of a serene Arcadia? None of these images has any longer any relevance. The artist must now create new images, images of a possible new world, a world possible in this era of scientific transformation. And this is what the constructive artist is trying to do. 'He has found the means and the methods,' as Gabo says, 'to create new images and to convey them as emotional manifestations in our every day experience.' The images he creates—images such as Gabo himself has created—are not arbitrary or insignificant: they are not, as they are so often called, "abstractions."

"They are a factual force and their impact on our senses is as real as the impact of light or of an electric shock. This impact can be verified just as any other natural phenomenon. Shapes, colors, and lines speak their own language. They are events in themselves and in an organized construction they become beings—their psychological force is immediate, irresistible and universal to all species of mankind; not being the result of a convention, as words are, they are unambiguous, and it is for that reason that their impact can influence the human psyche; it can break or mold it; it exults, it depresses, elates or makes desperate; it can bring order where there was confusion and it can disturb and exasperate where there was an order.'

"But a constructive image, Gabo points out, is not just any image but one 'which by its very existence as a plastic vision should provoke in us the forces and the desires to enhance life, assert it and assist its further development.'

"Can we already detect the transforming influence of such images? We must not be impatient, for human consciousness extends its range very slowly, very cautiously, but we can already discern, in certain tendencies of modern architecture and planning, the presence of images that arise not so much from utilitarian or functional necessity, as from a sense of vitality which is conveyed by this new plastic vision."

—*F. L. Kunz*

The illustration on the cover is taken from the book, Plate 84: Twinned column, bronze, height 40½ in., by Antoine Pevsner, 1947.

Perspectives on Education: 1955

THE year 1955 saw such a great outpouring of words about education that it may well be termed "the year of educational discussion." As usual this flood of words probably conveyed more heat than light. Polemic and diatribe and statistic were prominent while the truth struggled along more in spite of than because of the verbiage and the excitement.

Toward the close of the year, Joan Dunn, a former

New York City school teacher, gave us *Retreat from Learning* (David McKay Company, Inc., New York, 1955, 224 pp., $3.00), subtitled "Why Teachers Can't Teach—A Case History." Here, once again, we are given the undramatized details of "blackboard jungle," a recital of the frustrations of a teacher caught up in the toils of an overburdened school system which even the author should admit has had to become a mill and a rat race of administrative ritual in order to keep from becoming even more of a jungle.

Much blame is placed upon "progressive education" and considerable effort is spent (especially in the preface) in beating the ghost of John Dewey. As usual, alas, the author joins her peers and confreres in decrying the lack of dicipline, the absence of manners and morality, and all the rest of the sorry picture of our times. As usual (even in so august and expensive a venture as the recent White House Conference), the point is missed—the lowering of the cultural level generally reflects in the "watering down" of curriculum, the ahedonia of meaninglessness reflects in undisciplined behavior. Although the reviewer acknowledges that Miss Dunn tried valiantly to "put over" some of the content of her subject, English, before she gave up her teaching, we wish she had devoted more of her space to the real nub of the problem, which is meaningful content, related, courageously brought down to earth and made alive. When, oh, when, will the academicians acknowledge that in every school and in every village and hamlet there is a "Nina, curator of the school pornography"? When will we wake up to the fact that the Ninas of this world give devoted teachers a run for their money and attention because the Ninas may have more in the way of exciting content to offer than we academicians?

So here is another Jeremiad—another unconscious appraisal of the ills of our times—another libel on the word "jungle."

On the other hand, the year closed with *In Quest of Knowledge,* an Historical Perspective on Adult Education, by C. Hartley Grattan (Association Press, New York, 1955, 337 pp., notes, index, $4.75). This volume which, we are told, was made possible through the sponsorship of the Fund for Adult Education established by the Ford Foundation, is a scholarly history of the adult (or, should we say, the *continuing*) education movement from preliterate days in Greece and Rome, in medieval times, through British institutes, Lyceums, Chautauqua, etc., through radio and other mass media, down to present-day discussion groups and the like.

This is an excellent historical study. It serves to put the program chairman of the local service club and the director of adult education in your community in very good company indeed (from Pericles and Socrates to Toynbee, no less). This is excellent material. It is much needed. And, Heaven knows, adult education is needed. Again, however, the question, unfortunately, is begged. The reviewer could not find anywhere in the volume an analysis of the strong urgency to find meaning, at-one-ment, and integration by those who, having been exposed to the normal processes of "education," discover in later years a need for at least an intellectual "rite of identification" with which to assuage their hunger. We believe in arts and crafts and we have little to argue against the value of the busy work of adult education as it is found in many places. We do feel that more is needed than affording an opportunity for adults to come "near the fount." Again, we plea for *content*—and we mean meaningfully integrated content.

The new year, 1956, begins (or continues) the discussion with *How to Get Better Schools* (A Tested Program) by David B. Dreiman (Harper & Brothers, New York, 267 pp., Appendices, $3.50). With a foreword by Roy E. Larsen, chairman of the National Commission for Public Schools, this book enters the controversy about our schools with something of a summing up of the work of the Commission. The "tested program" is a citation of the results of the local action for better schools in five communities from Connecticut to the state of Washington.

This is good, solid material and we welcome it. Certainly we can have only as good schools as the culture of our communities require. Boards of education, administrators, and teachers need help sorely. No reader of MAIN CURRENTS should continue his subscription beyond this issue if he remains inarticulate in his local educational problems. This is a fine start toward getting better schools—insofar as it should serve as a guide book for those who should be "getting their baptism of fire" in local school matters for the first time. Let us have more public participation. However, let us emphasize that "better schools" does not mean only better buildings and less crowding of pupils—and more teachers with better pay; it also means assurance that what is taught and how it is taught shall (through the lives of those now in school) make the future more livable and more worth while for this strange creature called man.

—Harvey W. Culp

Psychological Eclecticism

TO the list of books dealing with frontier thinking in biology and psychology which we have reviewed in recent issues, we gladly add another. This volume is *Becoming,* by Gordon W. Allport (Yale University Press, New Haven, 1955, 106 pp., index, $2.75).

This volume is another in which an eminent psychologist sums up his mature experience to confront the problems and dilemmas of modern psychology which, he says, is not a unified science like mathematics or physics, ". . . but rather a collection of facts and opinions whose relevance to human welfare and religion depends upon the particular opinions and facts one selects for consideration. Yet despite its diffuseness the psychological mode of thinking is distinctive and is at the present time astonishingly popular." Here lies a danger for, if psychology is becoming so popular as to make this the Psychological Age, the concepts of psychology must be clear, valid, and sufficiently inclusive of all the subtleties of the human mind and spirit as to make their "popularity" safe for men to shape their destinies. "While it is surely the task of science," says the author, "to bring order among facts without needless proliferation of concepts, yet over-simplification brings discredit upon science, and in psychology may succeed only in caricaturing human nature." And we cannot make anything but trouble for ourselves and can only bring disaster if our concepts are caricatures.

"Personality is far too complex a thing to be trussed up in a conceptual strait jacket," says Dr. Allport. "Starting with this conviction the present essay argues for con-

ceptual open-mindedness and for reasoned eclecticism." The essay, which bears the sub-title "Basic Considerations for a Psychology of Personality," begins with an excellent critique of the science, examines the Lockean and Leibnitzian traditions and their influence upon our concepts of man, and shows very lucidly that "Up to now, the 'behavioral sciences,' including psychology, have not provided us with a picture of man capable of living in a democracy. These sciences in large part have imitated the billiard ball model of physics, now of course outmoded. They have delivered into our hands a psychology of an 'empty organism,' pushed by drives and molded by environmental circumstances. What is small and partial, what is external and mechanical, what is early, what is peripheral and opportunistic—have received the chief attention of psychological system builders. But the theory of democracy requires also that man possess a measure of rationality, a portion of freedom, a generic conscience, propriate ideals and unique value."

We wish that all teachers of psychology would join the present reviewer in making this little, closely-written volume required reading for their classes. What is needed, indeed, is a psychology of *becoming* which includes growth, life, and the full richness of personality—a psychology which seeks to know man's goals and potentialities as well as his origins, his limitations, and his pathology. Such a psychology, says Dr. Allport, "can best be discovered by looking within ourselves; for it is knowledge of our own uniqueness that supplies the first, and probably the best, hints for acquiring orderly knowledge of others."

—Harvey W. Culp

A Psychoanalytical View of Education

MR. Gerald H. J. Pearson considers what psychoanalytic research has to contribute to the theory and practice of education in a book entitled *Psychoanalysis and the Education of the Child* (W. W. Norton and Co., Inc., New York, 1954, 357 pp., index, $5.00).

The information is organized under three major headings: Psychoanalysis and the learning process, Ego psychology and the education of the child, and Psychoanalysis and the development of the moral sense. In the first section Dr. Pearson deals with disorders of the learning process, the organization of the ego, the development of the relation with the external world, etc. In the second section are included the defense mechanisms of the ego, a redefinition of "creativity," and the relation of the reality principle to education. The third section considers the functions and development of the superego and the task of education in its development, the functions and development of the ego ideal, and suggestions on the relationship between psychoanalyst and educator.

Dr. Pearson writes clearly with an interesting style. The reader is always aware of his strong convictions and deep concern about the problems he discusses. This is not a popular book. The language assumes that the reader already has a good vocabulary in psychology; however, the directness of the presentation and the liberal use of cases as illustrations of his points makes it possible for an interested layman to understand his basic ideas. His discussion on the stages of development of the child is particularly valuable. The author gives examples "which indicate the importance to the educator of understanding the stages of libidinal development and utilizing this knowledge practically to help the particular child toward the sublimations which he needs most. This understanding is essential in connection with the tendency to impose the creative arts on children in order to "teach them creativity." The understanding educator will provide opportunities for the use of the creative arts, but will not insist that every child take part in them all.

"Finally, every educator should recognize the great importance of helping the child gradually to place himself under the supremacy of the reality principle rather than the pleasure-pain principle. Particularly in the latency period, this is the role of the professional educator more than of the parent."

Dr. Pearson, in discussing ways in which the school curriculum could furnish the child with opportunities, both vocational and recreational, for sublimation, recommends numerous additions to what even the most diversified curriculum now offers.

"No educator can inculcate creativity. The most that the educator can do is to give the child the opportunity to see whether any subject, including the arts, will furnish a medium for the sublimation of that specific pupil's drives. . . The educator who understands well the psychosexual development of the child and the points at which sublimations of pregenital drives begin, can use this knowledge in deciding when to teach the child the skills of a particular sublimation; but he will also have to recognize that parts of these skills have to be learned through hard, unpleasant effort and that he must encourage the child to undertake and carry to completion the difficult parts of each task."

Dr. Pearson describes the formation of the ego ideals which influence motivations and attitudes the rest of our lives. He shows the part that beloved teachers play in this process. "The unconscious incorporation of the teacher into the ego ideal of the child places a tremendous responsibility on the teacher and on those who select the teachers for any school system." He recommends some methods of subsidy "or the establishment of scholarships for the psychoanalysis of student teachers" because of the tremendous value this would have as a part of the curriculum for the training of teachers and the prohibitive expense of the process at present.

The author is concerned about our rejection of some of the codes and ideals of Western civilization and asks, "if some of those remaining are so distinctly unrealistic that they are causing maladjustments for the adolescent and young adult, what are we evolving to replace them and what type of replacement are we teaching our children both by precept and by example? . . . I do believe that new ideals will have to be evolved to replace those that are being lost.

". . . I have no answer to this question, nor am I in a position even to suggest one. It is a question which should be under consideration by educators. It seems to me that the answer will come only from the combined careful thinking and planning of educators, psychologists, statesmen, and historians . . ."

This is one of the most challenging and informative books I have ever read on the subject of learning and human behavior in general. I cannot recommend it too highly.

—Ruth Lofgren